

# **Plaintiffs' Exhibit 29 (Redacted)**

**IN THE UNITED STATES DISTRICT COURT  
FOR THE EASTERN DISTRICT OF VIRGINIA**

**Alexandria Division**

UNITED STATES, et al.,	)	
	)	
Plaintiffs,	)	
v.	)	No. 1:23-cv-00108-LMB-JFA
	)	
GOOGLE LLC,	)	
	)	
Defendant.	)	

**DECLARATION OF RAMAMOORTHY RAVI  
IN SUPPORT OF PLAINTIFFS' OPPOSITION TO  
GOOGLE'S MOTION FOR SUMMARY JUDGMENT**

Ramamoorthi Ravi, PhD., being duly cautioned, declares as follows:

1. I am over 21 years old and am competent to testify about the matters in this Declaration based on my personal knowledge.
2. Attached hereto as Exhibit A is a true and correct copy of the December 22, 2023, Expert Report of Ramamoorthi Ravi, PhD, along with associated errata. Attached hereto as Exhibit B is a true and correct copy of the February 13, 2024, Expert Rebuttal Report of Ramamoorthi Ravi, PhD, along with associated errata.
3. I authored the attached Expert Reports identified in Item (2) above and understood at the time I signed them that they were being prepared for use in this litigation. I am prepared to testify at trial, under oath, to the matters set forth in these reports. My statements set forth in these reports, as modified by associated errata, are true and correct to the best of my knowledge.
4. The exhibits attached to the reports described in Item (2) are true and correct copies.

I declare under penalty of perjury that the foregoing statements in this Declaration are true and correct.

Dated:

Signed: 

Ramamoorthi Ravi, PhD.

County and State:

HIGHLY CONFIDENTIAL

**IN THE UNITED STATES DISTRICT COURT  
FOR THE EASTERN DISTRICT OF VIRGINIA  
ALEXANDRIA DIVISION**

United States of America, *et al.*,

**Plaintiffs,**

**v**

Google LLC,

**Defendant.**

**Case No. 1:23-cv-00108**

**HON. LEONIE H. M. BRINKEMA**

**EXPERT REPORT OF  
RAMAMOORTHY RAVI, PH.D.**

**DECEMBER 22, 2023**

algorithm to set them in the best possible way for the next day.<sup>231</sup> Thus, both the volume of transactions permitting these experiments, as well as their availability at scale over time to detect any changes in market condition were crucial in successfully implementing these profitable schemes.<sup>232</sup>

### **III.B.4. Google Attempted to Use Google Ads' Dynamic Revenue Sharing to Disadvantage "Mediating" Publishers**

#### **III.B.4.a. Google Applied its Program to Disadvantage "Passback Mediation"**

122. One of the business practices that Google sought to limit was known as "mediation."<sup>233</sup> In this context, Google was worried that publishers might reach out to third-party exchanges before ultimately offering the impression for sale on AdX.<sup>234</sup> This would potentially allow competitors to "cherry pick" high value impressions and send already-rejected inventory to AdX.<sup>235</sup> Google referred to this type of behavior as "Passback" mediation.<sup>236</sup> Publishers used the practice to

<sup>231</sup>

[REDACTED]

<sup>232</sup> Note that this optimization is on top of the existing conversion of CPC to CPM, which itself requires scale to successfully implement. *See* Section II.B and Section IV for more details.

<sup>233</sup> GOOG-DOJ-06563186, at -187 (03/04/2015) ("Issues[:] Competitors continue to increase mediation of AdX/AdSense... Scope of mediation and impact on inventory value was unknown").

<sup>234</sup> GOOG-DOJ-27803533, at -535 (03/03/2015) ("Inventory available to AdX/AdSense increasingly being mediated & already passed on by other buyers").

<sup>235</sup> GOOG-DOJ-06563186, at -187 (03/04/2015) ("Competitors continue to increase mediation of AdX/AdSense[,] Remarketers using mediation to cherry pick high value cookies[,] Having multiple buyers view & pass on inventory before GDN reduces its value").

<sup>236</sup> GOOG-AT-MDL-006218257, at -262 (12/16/2022) ("Passback" is where Ad Manager is called from a third-party's ad tag...or where a publisher sets up a high-priority line item in Ad Manager's ad server representing a

deliver the impression in DFP to their pre-negotiated (non-Google) buyer at higher prices.<sup>237</sup> If the non-Google buyers “passed” on the impression, only then was it delivered to AdX as a mediated query. This is in contrast to “First Call,” where publishers called Google first.<sup>238</sup>

123. In a further internal refinement of Google Ads’ dynamic revenue sharing program, Google attempted to disadvantage publishers engaging in Passback mediation in favor of First Call publishers; this was known internally as “Project Bell.”<sup>239</sup> Note that while some publishers saw revenue declines under previous versions of the program, the declines were based on the competitiveness of the auctions. However, by trying to use the program to “punish” Passback publishers,<sup>240</sup> Google began using the identity of publishers as a criterion based on which impressions could receive subsidized bids, influencing which publishers benefited from the program and which did not.<sup>241</sup> Furthermore, despite Google Ads being a buy-side platform, managing bids for advertisers, Google Ads’ program would have had the effect of promoting some publishers at the expense of others.

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potential ad served by a third party, that ‘passes back’ to the normal Ad Manager ad server process to find an alternative ad if the third party system is unable to serve an ad.”); *see also*, GOOG-DOJ-AT-02199478, at -503 (06/11/2019) (“Passback means that when one ad system cannot fill an ad request it passes it back to a different ad system.”).

<sup>237</sup> GOOG-DOJ-06563186, at -189 (03/04/2015) (“Remarketers booking DFP line items (Remarketer1, 74% <P12) rather than buying through the auction....Exchanges...using Programmatic to book higher priority line items[,] Inventory available to AdX/AdSense increasingly being mediated & already passed on by other buyers”).

<sup>238</sup> GOOG-AT-MDL-006218257, at -262 (12/16/2022) (“‘First call’ is where the Google ad tag is called first (i.e., before a third-party’s tag) for an ad query.”).

<sup>239</sup> GOOG-AT-MDL-B-002093394, at -394 (09/30/2014) (“We need a new name. How about Project Bell, after Alexander Graham Bell who made the first call. Get it, first call?”). Note that this iteration of the program also went by “Project Bell V2”. [REDACTED]

<sup>240</sup> GOOG-DOJ-09475820, at -874 (03/21/2017) (“GDN is going to start making changes to its buying algorithm when multiple calls are made to Adx for a single piece of inventory. So passbacks (backfill in other SSPs) will be ‘punished’”).

<sup>241</sup> GOOG-DOJ-27803533, at -550 (03/04/2015) (“Unconstrained pool-building on “Passback pubs”[,] 10% constraint on pool-building on “First Call pubs” (same as v1)[,] Pool only spent on ‘First call pubs’”).

124. To achieve this, Google added a new derived feature for each impression in real time when sending it to AdX for an auction, called “First Look.”<sup>242</sup> In late 2014, Google launched this feature and informed buyers of this new field and its meaning.<sup>243</sup> Google identified publishers they wanted to penalize as Passback and referred to others as First Call. Google Ads would subsidize bids on First Call impressions but *would not* subsidize bids on Passback impressions.<sup>244</sup> Google identified 20 publishers as Passback for the initial experimental implementation.<sup>245</sup> Thus, Google identified certain publishers who would fund the program but be denied the program’s benefits, based on signals detecting mediation practices that Google did not approve.
125. Internal experiments indicated that the differentiation essentially shifted spend from publishers engaging in Passback mediation to competitive First Call impressions.<sup>246</sup> Furthermore, it resulted in a difference in yield of 20 percent between First Call and Passback publishers.<sup>247</sup> Google’s plan was then to communicate to publishers that buyers were valuing First Call “20-30%” more than Passback impressions.<sup>248</sup> Google then recommended that publishers call DFP first to maximize their yields.<sup>249</sup> That is, if publishers failed to make AdX their preferred exchange, then

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<sup>242</sup> GOOG-DOJ-03901693, at -700 (11/05/2014) (“Buyers... Launch ‘First Look’ signal to all buyers in RTB”). Note that this use of “First Look” is distinct from the first look advantage of seeing historical eCPMs as price floors in AdX, and is also distinct from the Google program “DFP First Look”—also known as “DFL”—which is discussed in Appendix C.6.a of my report.

<sup>243</sup> GOOG-DOJ-03901693, at -700 (11/05/2014) (“Q4[:]. . . Launch ‘First Look’ . . . Inform buyers of new RTB First Look field and meaning”); *see also*, GOOG-DOJ-27803533, at -549 (03/04/2015) (“Passback tag signal data: went live in Nov 2014.”).

<sup>244</sup> GOOG-DOJ-03901693, at -703 (11/05/2014) (“Constraint/methodology[:] Unconstrained pool-building on ‘Passback pubs’ [.] 10% constraint on pool-building on ‘First Call pubs’ (same as v1)[, and] Pool only spend on ‘First call pubs’”).

<sup>245</sup> GOOG-DOJ-03901693, at -709 (11/05/2014) (“Pick 20 publishers for which we know for sure that they are doing passbacks[.] Classify these 20 publisher[s] as ‘Passback’ in the signal shared with AdX buyers”).

<sup>246</sup> GOOG-DOJ-03901693, at -703 (11/05/2014) (“Effectively shifts spend from Passback pubs (and non-competitive First Call pubs) towards competitive First Call situations, giving GDN better access to good inventory.”).

<sup>247</sup> GOOG-DOJ-03901693, at -703 (11/05/2014) (“~20% yield differentiation between ‘First Call’ and ‘Passback.’”).

<sup>248</sup> GOOG-DOJ-03901693, at -704 and -709 (11/05/2014) (“Positioning: Buyers are valuing ‘First Call’ 20-30% higher than ‘Passback.’”).

<sup>249</sup> GOOG-DOJ-03901693, at -704 (11/05/2014) (“To maximize yield you should put DRX as ‘First Call’[.] If you don’t, you will get lower yield.”); Note that “DRX” (DoubleClick Reservations and Exchange) was Google’s platform that combined DFP and AdX and later became Google Ad Manager. *See* GOOG-AT-MDL-006190054, at -055 (06/15/2021) (“Several years ago, these two products [DFP and AdX] were unified into a single platform called DRX (DoubleClick reservations and exchange) but this has since been re-branded as Google Ad Manager (GAM) in Q4’2018”).

sharing program in first-price auctions rely on data from a high traffic scale for their effectiveness.

### **III.C. Google's Selective Application of Dynamic Sell-Side Fees Disadvantaged Rivals and Other Market Participants**

138. Google's ad exchange, AdX, generates revenue by deducting a percentage, as a revenue share, from the payment it receives from buyers before forwarding the remainder to the publisher.<sup>279</sup> In addition to buy-side dynamic revenue sharing, Google also implemented dynamic revenue sharing on the sell side via AdX.<sup>280</sup> In fact, as I detail below, AdX selectively applied its dynamic revenue sharing on non-Google demand sources to increase auction wins for AdX, including those for high-value inventory, while simultaneously limiting the same for rivals.
139. Below in Section III.C.1, I begin by describing AdX's dynamic revenue sharing feature, its evolution over time, and its eventual phasing out in 2019. In Section III.C.2, I describe how AdX's sell-side dynamic revenue sharing feature allowed Google to win more auctions, particularly auctions for higher priced inventory, and further disadvantaged rival exchanges. Next, in Section III.C.3, I describe AdX's targeted implementation of its dynamic revenue sharing feature on non-Google demand sources, specifically excluding Google's DV360 and Google Ads. As discussed below, this Sell-Side DRS was important to AdX for converting its last look advantage into auction wins against rival exchanges and helped AdX build scale at its rivals' expense. Finally, in Section III.C.4, I describe how AdX's dynamic revenue sharing feature—in all its versions—were made effective by Google's existing scale and access to relevant auction data, such that it allowed Google to maintain its targeted average revenue-share.

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<sup>279</sup> See Lee Report, Section II.D.

<sup>280</sup> GOOG-DOJ-AT-02321262, at -262 (05/09/2014) ("We would like to allow dynamic sell-side revshare on AdX so that transactions that would have not been cleared because of fixed sell-side revshare can be cleared.").

Moreover, Google continued running 0.1% background experiments to collect data to train the pWin model.<sup>426</sup>

194. Both Poirot and Marple are active as of 2023.<sup>427</sup>

### III.D.3. Google's Bid Shading Projects Helped Delay AdX's Move to First-Price Auctions by Insulating AdX from Competition

195. It was not a coincidence that the rise of header bidding in 2017 coincided with the launch of Project Poirot. Given that publishers moved to header bidding, exchanges had strong incentives to move towards first-price auctions,<sup>428</sup> and many major exchanges had moved to the first-price format by 2017.<sup>429</sup> Indeed, the academic literature indicates that once exchanges begin competing simultaneously, as in the header-bidding setup, they have an incentive to move to first-price auctions.<sup>430</sup> However, once exchanges move to first-price auctions, exchanges lose

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[REDACTED]

427 GOOG-AT-MDL-006218271, at -290 (01/06/2023) ("Project Poirot launched on 19 July 2017...globally and is still active today... Project Marple launched on 12 September 2018...and is still active today.").

428 Stylianos Despotakis, R. Ravi, and Amin Sayedi, "First-Price Auctions in Online Display Advertising," *Journal of Marketing Research* 58, no. 5 (2021): 888–907, at 889 ("This move [towards first-price auctions] came about in a variety of ways, including the introduction of "soft floors" that were set by the ad exchanges. While the publisher supplied a reserve price with the request for bids, called the "hard floor," each ad exchange would set another, higher value as a soft floor and change the rule of the local auction in the following way: if there were at least two bids above the soft floor, they participated in a regular second-price auction; with only one bid above the soft floor, the soft floor then served as the clearing price; with all bids below the soft floor but some still above the hard floor, the bids participated in a first-price auction. Note that by setting the soft floor sufficiently high, the auction format is effectively converted from a second-price to a first-price auction. Indeed, several exchanges such as AppNexus advised advertisers to bid in soft-floor auctions just as they bid in first-price auctions (Gubbins 2017). The lack of transparency about the values of the soft floors set in these auctions led to such intermediate formats being quickly replaced by the more transparent first-price format with a reserve price").

429 Stylianos Despotakis, R. Ravi, and Amin Sayedi, "First-Price Auctions in Online Display Advertising," *Journal of Marketing Research* 58, no. 5 (2021): 888–907, at 889 ("Since its introduction, header bidding caught on very rapidly and became the mainstream format of publishers by the end of 2016...Before header bidding was introduced in the display advertising marketplace, the auction format for selling display ads was the well-established second-price format...However, in early 2017, right after the introduction of header bidding, several ad exchanges began experimenting with a first-price auction format instead.").

430 Stylianos Despotakis, R. Ravi, and Amin Sayedi, "First-Price Auctions in Online Display Advertising," *Journal of Marketing Research* 58, no. 5 (2021): 888–907, at 899 ("Under waterfalling, an exchange could use its position in the waterfall sequence to differentiate itself from other exchanges. When exchanges use second-price auctions, they can use their set of the advertisers to differentiate themselves from other exchanges...However, the combination of header bidding and first-price auctions puts exchanges in direct



their differentiation since the ultimate winner is the highest bidder among all exchanges. As a result, competition among exchanges becomes fierce so that they likely engage in a “price war,” cutting their fees significantly.”<sup>431</sup>

196. Notably, it took two more years for Google’s AdX to finally move to a first-price format, making it the last major exchange to do so.<sup>432</sup> This slow transition goes against the prediction of the academic literature that the economic forces in competitive markets would push exchanges to adopt the first-price auction format when they compete for the same impression head-to-head as in the header-bidding setup. During this over two-year period, instead of having AdX adopt the first-price auction format, Google used other means to dry up header bidding, including Poirot, as explained above.
197. Poirot was a particularly effective response to header bidding.<sup>433</sup> For example, Google credited Poirot with reducing spend on other exchanges, while increasing DV360’s spend on AdX by 7 percent.<sup>434</sup> Furthermore, around the start of 2017, over 50 percent of DV360 spend was on 3PE (i.e. less than 50 percent was on AdX), compared to 35 percent in 2019.<sup>435</sup> In 2018, when Poirot was in effect, Google noted that DV360’s AdX bids were higher than 3PE bids 93 percent of the

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competition....[T]he move to first-price auction was necessary for an exchange to survive in the short run after the publishers adopted header bidding”).

<sup>431</sup> Stylianos Despotakis, R. Ravi, and Amin Sayedi, “First-Price Auctions in Online Display Advertising,” *Journal of Marketing Research* 58, no. 5 (2021): 888–907, at 899 (“While the move to first-price auction was necessary for an exchange to survive in the short run after the publishers adopted header bidding, after taking its effect on advertisers’ choices of exchanges into account, our results show that the move will lower the exchanges’ equilibrium buyer-side fees in the long run. This is consistent with several industry reports indicating a steep decline in exchange fees since the adoption of first-price auctions.”).

<sup>432</sup> Stylianos Despotakis, R. Ravi, and Amin Sayedi, “First-Price Auctions in Online Display Advertising,” *Journal of Marketing Research* 58, no. 5 (2021): 888–907, at 889 (“After Google’s move to first-price auctions in 2019, all major exchanges now use first-price auctions to sell display advertising impressions, when a publisher sends the request for bid to multiple exchanges.”); *see also*, Jason Bigler, “An Update on First Price Auctions for Google Ad Manager,” Google AdManager, May 10, 2019, <https://blog.google/products/admanager/update-first-price-auctions-google-ad-manager/>.

<sup>433</sup> GOOG-TEX-00085512, at -512 (03/16/2018) (“Our response to HB has been a multi-pronged effort, which includes a few projects...3. First-Price Auction Defenses in DBM...3. Poirot has actually been quite effective”).

<sup>434</sup> GOOG-TEX-00085512, at -512 (03/16/2018) (“3. Poirot has actually been quite effective, resulting in DBM spending 7% more on AdX and reducing spend on most other exchanges.”).

<sup>435</sup> GOOG-DOJ-11733552, at -553 (01/24/2020) (“DV360 three years ago[:] 3PE accounted for over 50% of DV360 spend”), and -578 (01/24/2020) (“DV360 spend on 3PE[:]” graph shows ~35% of Revenue going to “Exchange Traffic” (3PE) vs. ~65% going to “AdX Seller[s]” and other Google supply sources in 2019).

time.<sup>436</sup> Similarly, Poirot V2 experiments indicated that the program would result in a revenue loss of over 14 percent for 3PEs,<sup>437</sup> but an increase of 0.34 percent revenue for AdX.<sup>438</sup> Google did expect, however, that net revenue would increase by 3.39 percent from V2.<sup>439</sup> By May 2019, Poirot increased AdX revenue from DV360 by 20 percent.<sup>440</sup> Note that these changes did not arise from Google changing its auction structure or cutting its fees. Rather, it used DV360's scale to reduce bids into other exchanges.

198. There are at least three ways in which AdX benefited from Poirot at the expense of third-party exchanges. First, DV360's decreased bids made it easier for AdX to overcome header-bidding auctions via last look (discussed above in Section III.A.1). DV360 was a major source of bids in header bidding auctions, implying that the last look price floors on AdX often were the result of DV360 bids.<sup>441</sup> By lowering its advertisers' bids at exchanges running header-bidding auctions, DV360 could also lower what became the last look floor set by the best header bid, making it more likely that AdX could win the impression after getting that "last look."
199. Second, by lowering the bids made via DV360, Google could indirectly lower the last look floors set by the average winning bids at other exchanges. As described in Section III.A, the waterfall setup put AdX in a privileged position, where it only had to compete against the average historical prices of other exchanges. By bidding less at the third party exchanges, DV360—a major source of demand for many exchanges—could lower those historical average prices,

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<sup>436</sup> GOOG-DOJ-13605149, at -150 (04/25/2018) ("In the \$0-1CPM price bucket, DBM's win rate through external exchange is 62% (vs 5% on AdX). While DBM's AdX bid is higher than DBM's external exchange bid 93% of the time, and DBM's bid through AdX are blocked by adx pricing floors against DBM.").

<sup>437</sup> GOOG-DOJ-12059682, at -682 (08/10/2018) ("On 3PE...we see an aggregate surplus increase of 8.8% over all DBM traffic and 13.6% over Fixed CPM DBM traffic. This comes at a revenue loss of 19.7%...we project this loss to be at -14.4%.").

<sup>438</sup> GOOG-DOJ-12059682, at -683 (08/10/2018) ("1% experiment from Aug 11, 2018 till Aug 19, 2018...DBM x AdX[:].Revenue[:].0.34%").

<sup>439</sup> GOOG-DOJ-12059682, at -682 (08/10/2018) ("Total projected...net revenue increases by 3.39% which translates to +41\$M annualized. Note: the original Poirot launch was twice as impactful").

<sup>440</sup> GOOG-DOJ-07835340, at -347 (05/09/2019) ("[S]tatus quo...Pros[:].Poirot shifts money away from dirty auctions, currently increases AdX revenue by 20%.").

<sup>441</sup> GOOG-TEX-00096393, at -393. (06/21/2018) ("DBM self-competes between header bidding and AdX (DBM bid via header bidding acts as a pricing floor for AdX and DBM bid via AdX can be priced by DBM's bid via header bidding).").

making it easier for AdX to clear the first look floors set by historical averages and win in the waterfall.

200. Third, by spending less at other exchanges, Google freed up money that its advertisers could spend on AdX. That is, by spending less on other exchanges—both by paying less for auctions won and by losing more auctions—the money that would have been spent on competitors’ platforms was instead spent on AdX.<sup>442</sup> Indeed, this effect was so pronounced that Google worried about how to explain to advertisers and other exchanges why DV360 went from less than half its volume being sent to AdX<sup>443</sup> to sending over 70 percent of its spend to AdX.<sup>444</sup>

#### **III.D.4. AdX Did Not Run Clean Second-Price Auctions Yet Google Did Not Decrease Bids on AdX**

201. Google’s stated motivations for the initial version of Poirot was to protect DV360 advertisers from “overbidding” into exchanges that were not running “clean” second-price auctions.<sup>445</sup> For example, Google cites exchanges running second-price auctions with soft-floors as potential targets to decrease bids. Google’s exchange AdX, however, without participating in header bidding, did not implement clean second-price auctions either. Deviations from clean second-

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<sup>442</sup> GOOG-DOJ-07285943, at -950 (12/17/2018) (“DBM...2. Growth recovery strongest on Network inventory, as Poirot launches drive spend to AdX from 3PE (now flat Y/Y).”) and at -954 (“3PE: DBM on 3PE, AwBid[:] 3PE at 81% of Plan as growth falls negative in Q4 as Poirot exaggerates decline from GDPR...1. Perf on NonGoogle (3PE) declining to 81% of Plan vs 86% in Q3, as Poirot launches reduce bids on 1P 3PE auctions...Awbid is at 54% [spend compared] to Plan...Of the 46ppt miss vs Plan...13ppt from Poirot[.] DBM [at] 90% [spend compared] to Plan vs 96% in Q3, falling in Q4 with Poirot’s complete rollout. Of the 18ppt decline vs pre-GDPR: 10-14ppt estimated from Poirot”).

<sup>443</sup> GOOG-DOJ-10806862, at -862 (04/25/2017) (“Over half of DBM bidding goes through third-party exchanges”).

<sup>444</sup> GOOG-DOJ-AT-00060011, at -011 (01/04/2019) (“AdX is now dominant to the point where we need to communicate to advertisers (and sometimes even to exchanges) why over 70% of DBM spend happens on AdX”).

<sup>445</sup> See Appendix F.1; see also, GOOG-DOJ-10806862, at -862 (04/25/2017) (“Over half of DBM bidding goes through third-party exchanges, many of which do not run clean second price auctions. Fixed CPM bidders have the same bid in these unclean exchanges as they do in clean exchanges, which is suboptimal. The goal of Poirot is to discover the exchanges that deviate from second pricing and bid appropriately on these to improve advertiser performance on these exchanges.”).

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revenue shares in the buy side and the sell side as I detail in Sections III.B and III.C, respectively that further increased the scale of its ad tech products. Finally, by taking away publishers' ability to diversify away from AdX as I explain in Section III.E, it removed additional obstacles in the undertaking. Taken together, Google designed its ad tech products for open web display advertising in ways that advantaged its own products while disadvantaging Google's rivals and Google's own customers (open web display publishers and advertisers).

A handwritten signature in black ink, appearing to read 'R. Ravi', written over a horizontal line.

Ramamoorthi Ravi, Ph.D.

December 22, 2023

**Expert Report of R. Ravi (December 22, 2023)--Errata**

Page	Paragraph	Footnote Original	Corrected	Reason
7	6	. "Nation Science Foundation (NSF)"	"National Science Foundation (NSF)"	Typo
14	14b	. "First, an ad tech product that struggles to gain thickness on one side likely will have difficulty gaining thickness on the other side as well."	"First, an ad tech product that struggles to gain thickness on one side of the platform likely will have difficulty gaining thickness on the other side as well."	Clarification
19	24.a	31 Deepak Sharma, "DSP vs DMP: Differences, Similarities, and Their Hybrid Model," March 3, 2023	Deepak Sharma, "DSP vs DMP: Differences, Similarities, and Their Hybrid Model," AdPushup, March 3, 2023	Corrected Citation
20	25	38 Deposition of John Dederick (The Trade Desk), July 28, 2023, 98:2 – 98:22	Deposition of John Dederick (The Trade Desk), July 28, 2023, 97:25–98:22	Corrected Citation
23	Figure 2	. ...adapted from GOOG-DOJ-02427435, at -261.	...adapted from GOOG-DOJ-04601261, at -261.	Corrected Citation
23	30	53 ("For publishers, this server-to-server setup means you are not constrained by the limitations of client-side ad code, and can integrate different ad formats.").	("Kevel is a fully featured ad server that can serve any creative and any ad format").	Corrected Citation
53	91	184 0.85 * \$0.64 = \$0.55.	0.86 * \$0.64 = \$0.55.	Typo
70	125	248 GOOG-DOJ-03901693, at -704 and -709	GOOG-DOJ-03901693, at -704	Corrected Citation
70	126	251 ("10% constraint on pool-building on 'First Call pubs' [i.e. at most (10% in pool building - 0% in pool payouts) can be lost for a First Call publisher]").	("10% constraint on pool-building on 'First Call pubs']"). I.e. at most (10% in pool building - 0% in pool payouts) can be lost for a First Call publisher."	Corrected Citation
82	151	304 GOOG-DOJ-13227256, at -256	GOOG-DOJ-13227256, at -260	Corrected Citation
88	162	338 GOOG-AT-MDL-004061913, at -914	GOOG-AT-MDL-004061913, at -915	Corrected Citation
91	170	352 GOOG-DOJ-11728951, at -945	GOOG-DOJ-11728951, at -954	Corrected Citation
101	189	407 GOOG-DOJ-AT-02635025 at -027	GOOG-DOJ-AT-02635025, at -027 (08/19/2018) ("[P]roposed model updates:...minimum multiplier[:]...0.1").	Corrected Citation
105	196	432 Jason Bigler...-google-ad-manager/.	Jason Bigler...-google-ad-manager/ ("May 10, 2019...Google Ad Manager will be transitioning to a unified, first price auction this year.").	Corrected Citation
110	205	457 GOOG-DOJ-13204676, at -676–77	GOOG-DOJ-13204676, at -676	Corrected Citation

**Expert Report of R. Ravi (December 22, 2023)--Errata**

Page	Paragraph	Footnote	Original	Corrected	Reason
117	219	504	...September 5, 2019, https:...partners/.	...September 5, 2019, https:...partners/ ("As we announced in March, we're transitioning to unified first price auctions for Google Ad Manager").	Corrected Citation
124	234		. "Google had to convert pricing from "cost per click" (CPC) or into "cost per mille" (CPM)."	"Google had to convert pricing from "cost per click" (CPC) into "cost per mille" (CPM)."	Typo
125	234	533	("Google will assume this click risk...")	("Google will assume the click risk...")	Typo
125	234	533	("...Google Ads is therefor taking on risk...")	("...Google Ads is therefore taking on risk...")	Typo
127	238	542	("...It feeds right back to that organization concept that...")	("...It feeds right back to that optimization concept that...")	Typo
136	255.a	579	GOOG-TEX-00119815	GOOG-TEX-00119815, at -816	Corrected Citation
141	259.a		. "...exclusive access to areas where Google has a massive dominant presence..."	"...exclusive access to areas where Google has a massive and dominant presence..."	Typo
144	261	610	Deposition of John Dederick (The Trade Desk), July 28, 2023, 8:3–5	Deposition of John Dederick (The Trade Desk), July 28, 2023, 8:2–5	Corrected Citation
145	264		. "Mr. Pauley further testified that those expected loss of revenue from AdX would "significantly limits [Vox's] interests or ability to switch any ad servers.""	"Mr. Pauley further testified that the expected loss of revenue from AdX "significantly limits [Vox's] interests or ability to switch any ad servers.""	Typo
181	Appendix B	[183]	GOOG-DOJ-AT-00621759	GOOG-DOJ-AT-006217592	Typo
181	Appendix B	[209]	GOOG-AT-MDL-01168711	GOOG-AT-MDL-011687119	Typo
182	Appendix B	[283]	GOOG-DOJ-11726039	GOOG-DOJ-11726308	Typo
187	268c		. "This value CPM is the historical average CPM delivered by each SSP/Exchange for that line item."	"This value CPM could be the historical average CPM delivered by each SSP/Exchange for that line item."	Correction
196	280		. "header bidders were blind to the tCPM or any other price reservations set by DA, which lowered their chances of winning an auction on AdX."	"header bidders were blind to the tCPM or any other price reservations set by DA, which lowered their chances of winning an auction against AdX."	Correction
207	296		. "...and kept the difference as the 14 percent revenue share (if the bid of \$0.96 won the auction)."	"...and kept the difference as the 14 percent revenue share (if the bid of \$0.96 set the price)."	Correction
210	301	722	GOOG-DOJ-28386151, at -166	GOOG-DOJ-28386151, at -157	Corrected Citation

**Expert Report of R. Ravi (December 22, 2023)--Errata**

Page	Paragraph	Footnote	Original	Corrected	Reason
210	302		. "... for a major part of the project's duration, Google charged advertisers the full value of their bid."	"... for a major part of the project's duration, Google charged advertisers the full value of their bid for competitive auctions."	Clarification
211	303	725	As a result, the advertiser does not pay their own first-price, and the truthfulness of the ion is preserved.	As a result, the advertiser does not pay their own first-price, and the truthfulness of the auction is preserved.	Typo
213	308		. "...which allowed publishers to subjected margins more or less than 15 percent..."	"...which allowed publishers to be subjected to margins more or less than 15 percent..."	Typo
217	314	754	"google-ads/answer/7065882."	"google-ads/answer/7065882 ("Smart Bidding refers to bid strategies that use Google AI to optimize for conversions or conversion value in each and every auction...Target CPA, Target ROAS, Maximize conversions, and Maximize conversion value are all Smart Bidding strategies.")"	Corrected Citation
220	321	770	GOOG-AT-MDL-009709715, at -103	GOOG-AT-MDL-009709715, at -716	Corrected Citation
220	321	771	GOOG-AT-MDL-009709715, at -103	GOOG-AT-MDL-009709715, at -716	Corrected Citation
222	323	783	("We whould like to adjust the adrevenue share on a per-query...").	("We whould like to adjust the adx revenue share on a per-query...").	Typo
230	338	827	... and at -074...	... and at -075...	Corrected Citation
231	339	828	("... Truthful DRS applied to RTB and 30% of DBM/GDN")	("... Truthful DRS applied to 90% of RTB and 30% of DBM/GDN")	Corrected Citation
235-236	347		. "The reason for using a quadratic function was that bidder surplus should peak for at bid-shading factor of less than one..."	"The reason for using a quadratic function was that bidder surplus should peak at a bid-shading factor of less than one..."	Typo
238	353	878	GOOG-DOJ-AT-02434618	GOOG-DOJ-AT-02434618, at -618	Corrected Citation
240	357	894	GOOG-DOJ-AT-02512863	GOOG-DOJ-AT-02512863, at -864	Corrected Citation
254	Fig. 18	[9]	GOOG-DOJ-AT-02242745	GOOG-DOJ-AT-02242745, at -745-746	Corrected Citation

